10-20-04   1081561o

(12) UK Patent Application (19) GB (11) 2 287 150 (13) A

(21) Application No 9403690.2

(22) Date of Filing 25.02.1994

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(51) INT CL⁶
H04N 1/028 , G06K 7/10

(52) UK CL (Edition N)
H4F FCA FS25R FS27A1 FS27R2 FS27R9 FS30K FS42A
FS70 FS83X
G4M MB4 MCC
G4R REV R1C R1X R8F R9B

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GB 2247376 A   GB 2198009 A   GB 1601323 A
EP 0568140 A1   EP 0227413 A2   EP 0127478 A2
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(58) Field of Search
UK CL (Edition M) G4M MCC , G4R RET , H4F FCA
FCK FDB FJB
INT CL⁵ G06F 7/10 , G06K 9/00 , H04N 1/028
Online databases: WPI

(54) Image capture device and barcode reader

(57)   This invention relates to an image capture device, which is particularly suitable for, but not exclusively intended for the capture of two-dimensional images such as signatures and other monochrome images. A scanning light source (10) and a photodetector (20) are used to capture the image, which is sampled at a rate determined by the optical scanning. The image may be displayed and/or stored.

Means for decoding a barcode may be provided and activated manually or automatically on recognition that the image is a barcode.
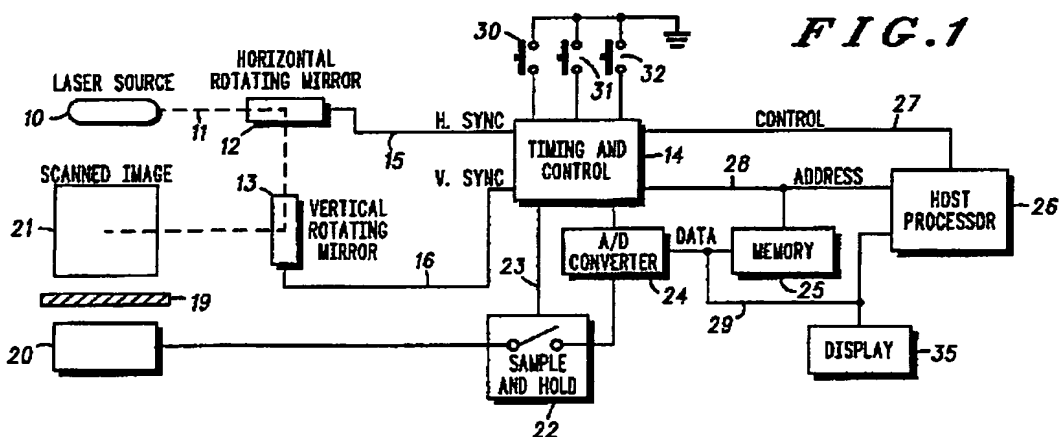

FIG.1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

GB 2 287 150 A

FIG.1

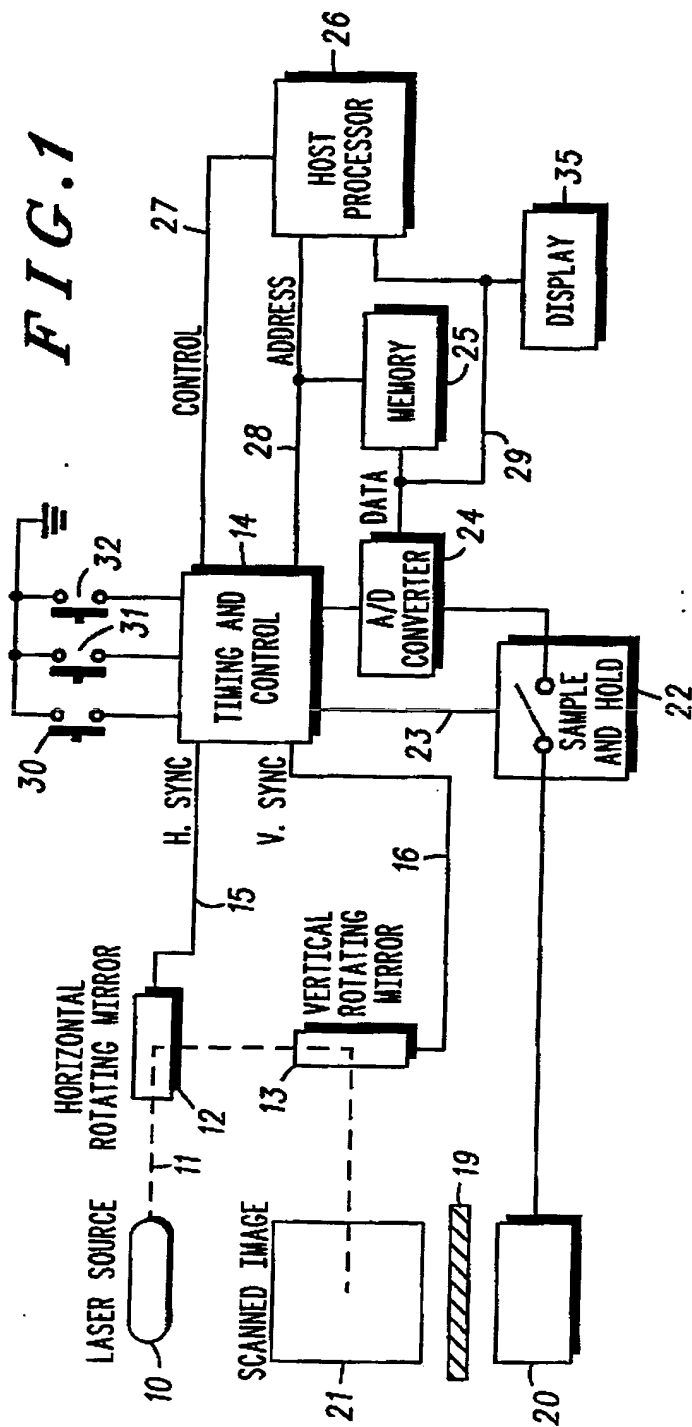# FIG.2

IMAGE CAPTURE DEVICE AND METHOD OF RECORDING A SIGNATURE

<u>Field of the Invention</u>

5

This invention relates to an image capture device, which is particularly suitable for, but not exclusively intended for the capture of two-dimensional images such as monochrome images.

10   <u>Background to the Invention</u>

Electronic image capturing has developed from the well known television camera to inexpensive and compact charged-coupled-device (CCD) arrays as are commonly used in video cameras. CCD cameras are expensive 15   and their use in decoding images, such as bar codes, is embryonic, so that software for performing image decoding is either not available, or untested, or expensive.

Mechanical scan arrangements are known, which use line CCD or photo diodes and mechanical movement of the scanning device for the image 20   to perform line-by-line scanning, but these are cumbersome and subject to mechanical failure.

Common bar code scanners use a scanning laser beam, scanning in a one-dimensional line, with a further diode which measures reflected light to identify a binary image as a code. The scanner identifies transitions 25   between dark and light in the reflected light and, from these transitions, identifies broad and narrow bars of a bar code, the thickness of the bars being representative of coded information.

Another type of bar code scanner is a scanner for a two-dimensional code such as PDF-417, which is a standard for a two-dimensional label. 30

<u>Summary of the Invention</u>

In accordance with the present invention, an image capture device is provided comprising: a light source for producing a light beam; scanning 35   means for scanning the light beam across a scan area so as to scan an image to be captured, when positioned in the scan area; light sensitive means for measuring light from the light beam reflected from the image, to produce a signal of varying magnitude representative of the image; sampling means for sampling the magnitude of the signal to provide a series of image samples,

and synchronization means for synchronizing the sampling means and the scanning means.

In this manner, a scanning light beam, such as is used in a bar code reader, is reflected from the image and is sampled such that not only do mere transitions between dark and light give rise to recorded data, but grey-scale information is captured to create a complete image.

The invention benefits from advantages of bar code readers and provides a simple and useful method of capturing an image. For example, the arrangement is particularly suitable for capturing a signature. The signature can be given with a simple ink pen on a piece of paper and it can be scanned using the device, at a distance of typically 2 to 20 cm, making the capturing of the signature a simple operation.

According to a further aspect of the invention, a method of recording of a signature is provided, comprising the steps of providing a signature on a contrasting background, scanning the signature with a light beam, measuring light reflected from the signature to produce a signal representative of the signature, sampling this signal to produce a series of samples and storing this series of samples.

The light beam may be scanned using light diverting elements for diverting the light beam in first and second generally orthogonal directions. The diverting elements may be mirrors or prisms or, using the most recent technology, they may be solid state devices.

A light filter may be used to match the light sensitivity of the light sensitive means to the wavelengths of the light from the light source, thereby making the device relatively insensitive to ambient light conditions. This is a particular advantage over CCD array devices, which are generally dependent on the ambient light.

A display may be provided for displaying the captured image.

The captured image may be processed, for example it may be enhanced or otherwise improved, or it may be identified.

In a preferred embodiment of the invention, an image capturing device and a bar code decoding device are provided in a single unit using a light beam scanning arrangement for both image capture and bar code identification.

A preferred embodiment of the invention will now be described, by way of example only, with reference to the drawings.

Brief Description of the Drawings

Fig. 1 shows a block diagram of an image capture device in accordance with the preferred embodiment of the present invention.

5 Fig. 2 shows a typical raster scanning format used by the apparatus of Fig. 1.

Detailed Description of the Preferred Embodiment

10 Referring to Fig. 1, an image capture device is shown comprising a light source 10, for example a monochrome laser source, for producing a light beam 11. The device comprises a horizontal rotating mirror 12, a vertical rotating mirror 13 and timing and control circuitry 14 having a horizontal synchronization output 15 coupled to the horizontal rotating mirror 12 and a

15 vertical synchronization output 16 coupled to the vertical rotating mirror 13. A photodetector 20 is provided, in a position relative to the laser source 10 suitable for detecting light reflected by a scanned image 21. The photodetector is mounted at a position such that it can "see" the whole scanned image. A monochrome filter 19 matching the wavelength of the

20 light source 10 is positioned between the image 21 and the photodetector 20. The photodetector 20 has an output coupled to a sample and hold circuit 22. The sample and hold circuit 22 has a sample input 23 coupled to receive sample control signals from the timing and control circuitry 14 and it has an output coupled to an analog-digital (A/D) converter 24. The A/D converter

25 provides a digital output to a memory 25 via a data bus 29. The processor 26 receives control signals 27 from the timing and control circuitry 14. An address bus 28 couples the timing and control circuitry 14, the memory 25 and the host processor 26. The timing and control circuitry 14 has a number of optional keys or buttons 30, 31 and 32. A display 35 is connected to the

30 data bus 29.

The operation of the apparatus is as follows. The equipment can operate in two modes. The first mode is image capture mode and the second mode is image decoding mode. One or other mode may be commenced by manual key 30. The case will first be considered where the apparatus is in

35 image capture mode.

In image capture mode, the laser source 10 produces a laser beam which is reflected by the horizontal rotating mirror 12 and the vertical rotating mirror 13 onto an image 21 to be scanned and captured, for example a signature on a piece of paper. Timing and control circuitry 14 commences

a single raster scan as is shown in Fig. 2 by causing rotation of the horizontal rotating mirror 12 and the vertical rotating mirror 13 so as to complete a few raster scans of a predetermined area of the scanned image 21. During the scanning, the photodetector 20 provides a varying output,

5 which varies as the intensity of light reflected from the image 21 varies. Timing and control circuitry 14 provides sampling clock signals on line 23 to the sample and hold circuit 22. A/D converter 24 converts the samples to digital form and the resultant digital data is supplied to memory 25. It may be noted that this data is representative not merely of dark and light, but of

10 shades of grey. Timing and control circuitry 14 provides a control signal on line 27 to the host processor 26 identifying the commencement of a raster scan and the host processor 26 supplies a series of addresses on an address bus 28 causing the incoming data to be stored in a suitable area of memory 25 corresponding to a single frame of scanned image.

15   The image is now captured in memory 25, for later recall or for processing immediately or at a later time.

     By means of a manual key 31, a control signal can be provided to the host processor 26 to cause the image to be displayed on display 35. Display 35 is, for example, a liquid crystal display (LCD) with LCD driver circuitry.

20 The host processor 26 causes the data to be read out from memory 25 by supplying the necessary addresses on address bus 28 and a series of samples are output on data line 29 to the display 35. In this manner the user can check that the image has been correctly captured, for example that it was positioned reasonably centrally within the scan area.

25   In an alternative (and in fact preferred) embodiment, the image is simultaneously displayed on display 35 as it is scanned. When the operator is satisfied that the image is centrally located in the scanning area, he operates a key 32, which causes the host processor 26 to freeze the image in the memory 25.

30   Image decoding mode can be entered manually or automatically. For manual entry of this mode, the key 30 is used. Upon placing a particular image such as a bar code in the area of the image 21, the image is scanned as before, but this time the host processor 26 receives the data on line 29 and performs bar code decoding operations. For example, if the bar code is

35 aligned reasonably accurately and centrally in a direction with bars stretching vertically, the host processor 26 need do no more than identify high and low samples from the A/D converter 24, corresponding to white and black bars of the code, counting the number of sequential high samples or sequential low samples to determine the thicknesses of the adjacent bars of

the bar code. If the bar code is not aligned in an accurate alignment, or if it is a complex code, more complex processing may be necessary.

The operation can, in an alternative embodiment, switch automatically from image capture mode to image decoding mode as follows.

5   Upon commencement of scanning, a single image is captured in memory 25 and at the same time decoding operations are performed by host processor 26 on the data on the assumption that the image is a potential bar code. If the host processor 26 detects a predetermined number of sequences of high and low samples, representative of a predetermined number of lines of a bar

10   code (or alternatively, some other sequences of high and low samples within predetermined limits), the host processor 26 concludes that the image is indeed a bar code and outputs a decoded code on data line 29 and stores this code in a suitable address location using address bus 28. The code may be displayed on display 35 or may be read out at a later date.

15   It will be note that the horizontal and vertical rotating mirrors 12 and 13 may be implemented using resonators or polygons rotating on a high speed motor, as is well known in the art of two-dimensional bar code scanners. The horizontal scanning rate and the thickness of the beam determines the scanning resolution. The vertical mirror 13 rotates at a

20   slower rate to that of the horizontal rotating mirror 12.

The timing and control circuitry 14 synchronizes sample pulses from the A/D converter 24 with the mirror movements so that each sample belongs to a signal point on the image. The samples are stored in a frame memory 25 and later processed by the host processor 26.

25

CLAIMS

1.   An image capture device comprising:
        a light source for producing a light beam;
        scanning means for scanning the light beam across a scan area so as to scan an image to be captured, when positioned in the scan area;
        light sensitive means for measuring light from the light beam reflected from the image, to produce a signal of varying magnitude representative of the image;
        sampling means for sampling the magnitude of the signal to provide a series of image samples; and
        synchronization means for synchronizing the sampling means and the scanning means.

2.   A device according to claim 1 wherein the scanning means comprises first and second beam diverting elements for diverting the light beam in first and second generally orthogonal directions respectively.

3.   A device according to claim 2 wherein the beam diverting elements are rotating reflective elements.

4.   A device according to claim 1, 2 or 3 comprising a light filter for filtering light received at the light sensitive means so as to pass light of wavelengths generally corresponding to the wavelengths of light from the light source and to attenuate other wavelengths.

5.   A device according to any one of the preceding claims further comprising frame storage means for storing at least one complete frame of image samples, where a frame of samples corresponds to a complete scan of the scan area by the light beam.

6.   A device according to claim 5 further comprising display means coupled to the frame storage means for displaying an image from a frame of image samples.

7.   A device according to claim 6 wherein the display means comprises a liquid crystal display.

8.   A device according to any one of the preceding claims further comprising processing means for performing image processing operations.

9.   A device according to claim 8 wherein the processing operations
5   include image improvement operations.

10.   A device according to claim 8 or 9 wherein the processing operations include image identification operations.

10   11.   A device according to claim 10 wherein the processing operations include bar code decoding operations when the image is a bar code.

12.   An image capture device comprising:
       a light source for producing a light beam;
15   scanning means for scanning the light beam across a scan area so as to scan an image to be captured, when positioned in the scan area;
       light sensitive means for measuring light from the light beam reflected from the image to produce a signal representative of the image;
       sampling means for sampling the signal to produce a series of image
20   samples;
       synchronizing means for synchronizing the scanning means and the sampling means;
       processing means for performing bar code decoding operations; and
       control means for selectively enabling the processing means to
25   perform the bar code decoding operations to provide a decoded code and for selectively disabling the processing means from performing the bar code decoding operations and instead providing a direct representation of the image.

30   13.   A device according to claim 12, wherein the processing means are arranged to ascertain whether the image is a bar code and automatically to provide the direct representation of the image if it is ascertained not to be a bar code.

35   14.   A device according to claim 12 comprising actuation means for manually selecting between enabling and disabling of the processing means to perform the bar code decoding operations.

15.   A method of recording of a signature, comprising the steps of:
providing a signature on a contrasting background,
scanning the signature with a light beam,
measuring light reflected from the signature to provide a signal
representative of the signature,
sampling this signal to produce a series of samples and
storing the series of samples.

Patents Act 1977 **Examiner's report to the Comptroller under Section 17** **(The Search report)**	**Application number** GB 9403690.2	

Relevant Technical Fields (i) UK Cl (Ed.M) H4F (FCA, FCK, FJB); G4M (MCC) (ii) Int Cl (Ed.5) G06K 7/10; H04N 1/028	**Search Examiner** **MISS S E WILLCOX**
	Date of completion of Search **29 APRIL 1994**
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE DATABASE: WPI	**Documents considered relevant following a search in respect of Claims :-** **1**

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
X	EP 0051460 A2 (FUJI PHOTO FILM CO) see page 5, line 33 to page 6 line 20	1-3 at least
X	US 4800256 (IBM) see column 4 lines 12-46	1 at least

Databases:The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report)	Application number GB 9403690.2

Relevant Technical Fields (i) UK Cl (Ed.M) H4F (FCA, FD3); G4R (RET) (ii) Int Cl (Ed.) G06K	Search Examiner MISS S E WILLCOX

	Date of completion of Search 6 SEPTEMBER 1994

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A:	Document indicating technological background and/or state of the art.	**&:**	Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
Y	GB 2247376 A	(ALCATEL BUSINESS SYSTEM) see page 5, line 34 to page 7 line 5	15
Y	GB 2198009 A	(RICHARD MARK CHARLES) see page 3 line 16 to page 5 line 8	15
Y	GB 1601323 A	(XEROX CORPORATION) see Figures 1 and 2	15
Y	EP 0568140 A1	(PHILIPS) see whole document	15
Y	EP 0227413 A2	(LEO GIKEN CO) see Figure 4 and page 9 lines 5-23	15
Y	EP 0127478 A2	(REDIFFUSION COMPUTER) see whole document	15

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).